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ON-RESOLUTION OF TRANSPORTATION ISSUES IN FUZZY ENVIRONMENT EXPLOITATION RANKING FUNCTION

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ABSTRACT

The transportation problem was originally urbanized as a result of Hitchcock. In literature quite a lot of methods are anticipated for explaining the transportation problem in fuzzy environment. In this research article, we recommend an innovative algorithm for the IBFS in the direction of a Fuzzy transportation problem. To exemplify the projected methodology a arithmetical illustration is solved and also the gained results area unit matched up with the outcome of obtainable strategies. While the projected methodology could be a direct expansion of conventional methodology that the recommend methodology is extremely simple and easy to use on world transportation issues for the decision makers.

KEYWORDS: Fuzzy Sets, Triangular Fuzzy Numbers, Ranking Technique & Fuzzy Transportation Problem

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Original Article

1. INTRODUCTION

In arithmetic and economic science, transportation theory may be a reputation certain to the cram of best transportation and distribution of possessions. The problem was dignified by the French Mathematician Gaspard Mongein 1781. First study of transportation problem was mathematically done by Tolstoi. The transportation problem (TP) indicates to a special category of applied real life problems. Let the number of units of a product supply available at origin and be the number of units of the product demand required at destination. Let the cost of transporting one unit from product origin to product destination and let the amount of capacity carried or shipped from origin to destination. The area unit effective algorithms for resolution the transportation issues once all the choice parameters.

This is owing to measurement erroneousness, lack of indication, computational inaccuracy, high in sequence cost, whether conditions etc. Hence we tend to cannot apply the standard classical ways to resolve the transportation issues with success. Therefore the employment of Fuzzy transportation problems is additional acceptable to model and solve the important world issues.

Bellman and Zadeh [2] gives the perception of fuzzy decision making. Following the ground-breaking work, various researchers like Shiang-Tai Liu & Chiang Kao [8], Chanas et al [3], Pandian et. al [6]. Srinivasan [9] - [14] described the new methods to solve transportation problem in fuzzy environment. Nagoor Gani and Abdul Razak [5] attain a fuzzy solution for a 2-stage cost minimizing fuzzy transportation problem in which supply and demand are triangular fuzzy numbers.

2. PRELIMINARIES

In this fragment we tend to outline several necessary definitions which can be utilized in this paper.

2.1 Definition – 1

$\mu_{\tilde{A}}(x)$ is a function called the membership function and the set $\tilde{A} = \{(x, \mu_A(x)) : x \in A \text{ and } \mu_A(x) \in [0,1]\}$. is called a fuzzy set.

2.2 Definition – 2

$\widetilde{A}$ is a fuzzy set and defined of real number R, if its membership function $\mu_{\tilde{A}} : R \to [0,1]$ has the following characteristics

- $\widetilde{A}$ is normal. It means that there exists an x ∈ R such that $\mu_{\tilde{A}}(x) = 1$
- $\widetilde{A}$ is convex. It resources that for every $x_1, x_2 \in R$, $\mu_{\tilde{A}}(\lambda x_1 + (1-\lambda)x_2) \geq \min\{\mu_{\tilde{A}}(x_1), \mu_{\tilde{A}}(x_2)\},\ \lambda \in [0,1]$
- $\mu_{\tilde{A}}$ is upper semi-continuous.
- supp ($\widetilde{A}$) is bounded in R.

2.3 Definition – 4

$\widetilde{A}$ is a fuzzy number in R is said to be a triangular fuzzy number, if its membership function $\mu_{\tilde{A}} : R \to [0,1]$ has the following individuality.

$$\mu_{\tilde{A}}(x) = \begin{cases} \dfrac{x - a_1}{a_2 - a_1}, & a_1 \leq x \leq a_2 \\ 1 \quad , & x = a_2 \\ \dfrac{a_3 - x}{a_3 - a_2}, & a_2 \leq x \leq a_3 \\ 0 \quad , & otherwise \end{cases}$$

2.4 Ranking of Triangular Fuzzy number

Numerous approaches have been proposed for the ranking of fuzzy numbers. An economical come within reach of for scrutiny the fuzzy numbers is by the utilization of a ranking perform supported their hierarchal means. That is, for every $\widetilde{A} = (a^{(1)}, a^{(2)}, a^{(3)}) \in$ F(R), the ranking function $\Re$: F(R) → R by graded mean is defined as

$$\Re(\widetilde{A}) = \left(\frac{a_1 + 4a_2 + a_3}{6} \right) (\because a_2 = a_3)$$

For, any two fuzzy triangular Fuzzy numbers $\widetilde{A} = (a^{(1)}, a^{(2)}, a^{(3)})$ and $\widetilde{B} = (b^{(1)}, b^{(2)}, b^{(3)})$ in F(R), we have the following comparison

- $\tilde{A} < \tilde{B}$, If and only if $\Re(\tilde{A}) < \Re(\tilde{B})$
-
- $\tilde{A} > \tilde{B}$, If and only if $\Re(\tilde{A}) < \Re(\tilde{B})$
- $\tilde{A} \approx \tilde{B}$, If and only if $\Re(\tilde{A}) = \Re(\tilde{B})$
- $\tilde{A} - \tilde{B}$, If and only if $\Re(\tilde{A}) - \Re(\tilde{B}) = 0$

3. MATHEMATICAL FORMULATION OF A FUZZY TRANSPORTATION PROBLEM

Fuzzy transportation problem can be explicit mathematically as follows:

Minimize

$$z = \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij} \tag{1}$$

Subject to

$$\left.\begin{aligned} &\sum_{j=1}^{n} x_{ij} = \tilde{a}_i \quad j = 1, 2, \ldots, n \\ &\sum_{i=1}^{m} x_{ij} = \tilde{b}_j \quad i = 1, 2, \ldots, m \\ &x_{ij} \geq 0, \quad i = 1, 2, \ldots, m, \quad j = 1, 2, \ldots, n \end{aligned}\right\} \tag{2}$$

An obvious obligatory and adequate condition for the fuzzy linear programming problem

$$\sum_{i=1}^{n} \tilde{a}_i \simeq \sum_{j=1}^{m} \tilde{b}_j \tag{3}$$

This problem can also be represented as follows:

Table 1

	1	………	n	Supply
1	$\tilde{c}_{11}$	………	$\tilde{c}_{1n}$	$\tilde{a}_1$
. . . .	. . . .	. . . .	. . . .	. . . .
m	$\tilde{c}_{m1}$	……....	$\tilde{c}_{mn}$	$\tilde{a}_m$
Demand	$\tilde{b}_1$	………	$\tilde{b}_n$	

4. SOLUTION PROCEDURE

Following are the steps to solve Transportation Problem in fuzzy environment

Step – 1: Confirm whether the transportation problem in fuzzy is balanced or not. If it's balanced then attend step.

Step – 2: From the given fuzzy transportation problem, shift fuzzy values to crisp values using ranking function.

Step – 3: Deduct the minimum cell cost from each of the cell cost of every row/column of the Transportation problem and situate them on the right-top/right-bottom of subsequent cost.

Step – 4: Adding the cost of right-top and right – bottom and place the summation value in the corresponding cell cost.

Step – 5: Find the difference between minimum and maximum in each row / column which is called as row penalty / column penalty and write it in the side and bottom.

Step – 6: From that select the maximum penalty value. From the chosen row/column we would like to allot the minimum of supply/demand within the minimum part of the row or column. Eliminate by deleting the columns or rows admire wherever the availability or demand is satisfied.

Step – 7: Continue this process until satisfaction of all the supply and demand is met.

Step – 8: Place the original transportation cost to satisfied cell cost.

Step – 9: Calculate the minimum cost.

That is,

Total Cost = $\sum\sum C_{ij} X_{ij}$

5. NUMERICAL EXAMPLE

Consider the problem

Table 2

	FD_1	FD_2	FD_3	Fuzzy Capacity
FO_1	(4,5,6)	(3,4,5)	(6,7,8)	(3,4,5)
FO_2	(1,2,3)	(5,6,7)	(4,5,6)	(5,6,7)
FO_3	(3,4,5)	(7,8,9)	(2,3,4)	(4,5,6)
Fuzzy Demand	(4,5,6)	(5,6,7)	(3,4,5)	

Solution

Fuzzy transportation problem can be formulated in the following mathematical programming form

$$Min\ Z = R(4,5,6)x_{11} + R(3,4,5)x_{12} + R(6,7,8)x_{13} + R(1,2,3)x_{21} + R(5,6,7)x_{22} + R(4,5,6)x_{23} + R(3,4,5)x_{31} + R(7,8,9)x_{32} + R(2,3,4)x_{33}$$

$$R(4,5,6) = \frac{4+4*5+6}{6} = 5$$

Similarly

Table after Ranking

Table 3

	D1	D2	D3	Supply
O1	5	4	7	4
O2	2	6	5	6
O3	4	8	3	5
Demand	5	6	4	

With the help of this method, we can get the below solution.

Table 4

	D1	D2	D3	Supply
O1		4		4
O2	5	1		6
O3		1	4	5
Demand	5	6	4	

Hence $(3+3-1)=5$ cells are owed and therefore we got realistic solution.

Then the Total Cost = Rs. 49.6.

6. CONCLUSIONS

Ranking of fuzzy numbers is the imperative assignment of verdict making in fuzzy environment. Convert fuzzy transportation problem into transportation problem using a ranking technique. Numerical illustration projecting by this method, we can get the best optimal solution. This technique can even be utilized in finding alternative kinds of issues.

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